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DEPARTMENT OF COMPUTER SCIENCE

Synoptic Note on

"Image Compression Techniques with Application to 3D Medical Images"

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Synoptic Note

Title of the Research	: Image Compression Techniques with Application to 3D Medical Images.
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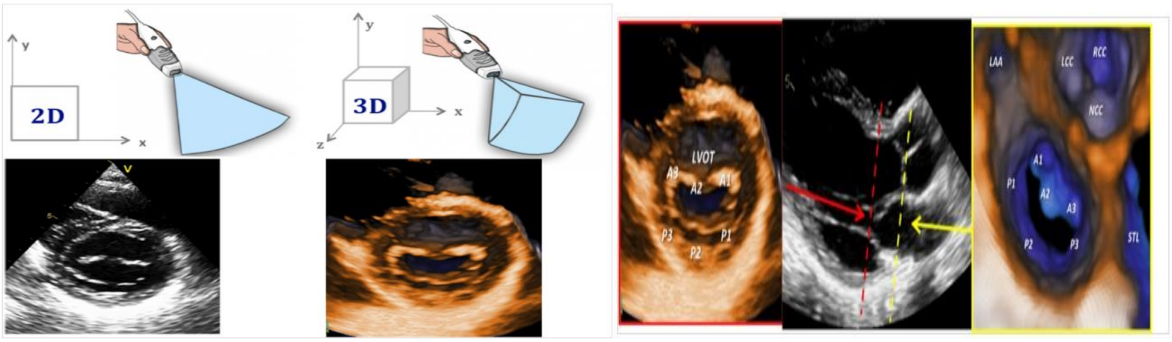
INTRODUCTION

Over the past decades, the amount of information handled by computers has increased exponentially as the Internet, multimedia, and high-definition television technologies have developed. Moreover, multimedia systems face serious challenges in storing and transmitting digital images. The problem with high-quality digital images is they require a large amount of storage space and transmission bandwidth that current technology cannot fulfill economically or technically. The solution is to compress the image information so that transmission time and storage space can be reduced. Recently, a great deal of interest in science has resulted from the growing demand for digital image processing. Recent advances in the field of developing higher-quality and lower-cost image acquisition devices, as well as conducting image processing using various image processing techniques, have led to the development of compression algorithms for compressing images suitable for large amounts of storage and transmission over low-bandwidth networks. Handling and processing of the volumetric medical images like Three Dimensional (3D) images encounters two challenging problems. The first problem is the monotonically increased storage requirements. The second one is the loaded medical networks where in telemedicine and teleradiology, patients in rural areas, where there are limited medical facilities, need to send their medical images and data over networks for consultation by a medical expert. Transmitting huge amount of medical images/data over a network would be very time-consuming.

The American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) recognised the need for a standard method for transferring images and associated information among devices manufactured by various vendors in the 1970s, with the introduction of digital diagnostic imaging and the increasing use of computers for clinical applications. The ACR and NEMA formed a joint committee in 1983 to face the problem. This led to the development of a standard, which is currently designated as the Digital Imaging and Communications in Medicine (DICOM) Standard, the field of medical data compression is challenging and gathers the interest and efforts of both the signal processing and the medical communities [1]. Medical imaging (X-ray, CT, MRI, ultrasound, etc.) is used to produce visual images of the inside of the body within a brief period of time for clinical diagnosis and medical intervention of complex diseases. For diagnosing, tracking, and/or treating medical problems, medical imaging methods are used to view the human body. Different modalities of imaging are based on various physical concepts which provide different details about the human body's structure, anatomy and function.

2D is defined as "flat" which has only two dimensions, horizontal and vertical (X and Y) dimensions. The depth (Z) dimension is added in 3D with X and Y dimensions. This third dimension enables rotation and visualization from various angles.



(a) (b)

Fig1. shows the difference between 2D, 3D views of echocardiography and surgical view of the image

Fig1.(a) represents only the mitral valve leaflet edges and the left ventricular wall may be seen with 2D imaging. In a realistic anatomic display, 3D volume modelling of the same valve permits appreciation of the entire leaflets, commissures, and interactions with adjacent structures (for example: left ventricular outflow tract).

Fig1.(b) shows the surgical view of the image, in contrast with 2D technique, 3D echocardiography allows the visualization of the structure of interest from virtually any desired perspective. For example, by 2D echocardiography the mitral valve can be seen from the ventricular perspective only, while by 3D echocardiography the mitral valve can be visualized both from the ventricular and the atrial ("surgical view").

Historically, scholars working in the subject of image and video coding have looked into medical image compression. The technological advancements in this field are a natural consequence of the progress made in the broader field of natural image and video coding. There is no golden rule: different coding methods work well for different sorts of images and settings, as one might assume. However, there are just a few universal standards that can be followed. The first is that using the entire data correlation increases compression in general. As a result, three-dimensional coding techniques have been created that are more suited for volumetric data applications. Additionally, incorporating motion correction could improve for time-varying data, such as image sequences (2D+time) and volume sequences (3D+time). However, depending on the imaging modality and application, some are better suited to achieving a certain goal, whether in terms of compression factor or, more broadly, in terms of desired functionality [1].

3D medical images are used in many clinical and research applications being increased. Due to their large file size the 3D images are in demands for storage and archiving resource. Image compression is typically used to remove unimportant information before sending the image to clouds to reducing data traffic. 3D digital medical imaging is currently an advancement in the overall field of medical imaging, but over the past two years it has doubled in size and is rapidly spreading into practice areas such as oncology, orthopedics, obstetrics/gynecology, cardiology, and dentistry. We are able to take those cross-section slices by using 3D technology in medical imaging and combine them into a succinct 3D visual of the region being scanned. A surgeon can see a true picture of the anatomy with 3D imaging and work.

3D medical imaging is a revolutionary optical imaging technology that provides an enriched image of the interior body for medical analysis by utilizing 3D imaging modalities. 3D medical imaging provides enhanced images of blood vessels and better images of bones. The increased the growth in network traffic because of multimedia data files like images, video and 3D data or images requires a data compression that have large impact on data centers concerning bandwidth, physical storage space and energy usage [2].

The advancement of medical imaging modalities and sensing techniques has led to the rapid proliferation of 3D imaging in the last two decades. These progresses have led to the production of vast amounts of medical images, placing a heavy burden on automatic image processing methods for diagnosis assistance. A large amount of medical imaging data must also be transmitted to accomplish telemedicine and remote diagnosis with no loss of information. In the medical field, storing 3D images for remote diagnoses is becoming more popular. The most important sector is remote areas where professionals may not be available to diagnose or treat patients. In these cases, 3D image compression can help because it reduces the size of the image as well as the transmission bandwidth and cost. As an instance, the required information can be transmitted over the network to experts, and using that 3D report, they can recommend diagnoses to concerned doctors from their workplace.

In the modern medical imaging field, several new technologies have been developed to provide high-quality medical data. A number of medical imaging modalities have proven success in producing 3D images in this context—including Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Positron Emission Tomography (PET), and Single Photon Emission CT (SPECT).

Analysis of such medical images/data has shown to be a developing field, with an increase in numerous services/applications connected to telehealth, biomedicine, and other telemedical analyses. The appropriate volume of data included in these medically produced images from procedures such as PET/CT, MRI, Bone Densitometry, Ultrasound, and other medically linked scans. These fields generate images that require more storage space, making management more challenging. These images, like the one used in Telemedicine, necessarily require high-speed networks for transmission. A proper DICOM file must be encoded, sent, and decoded at the receiving end in order to use telemedicine. As a result, an efficient technique is required that takes DICOM file encodes at the transmitting end, sends the file with a proper security clause, and receives and decodes the DICOM file.

The following are the comprehensive characteristics of compression methodologies for medical images/data that are considered among the variants:

- High lossless compression ratio.
- Resolution scalability: the capacity to scale or decode a compressed image at different resolutions.
- Image quality scalability: the capacity to scale or decode compressed images at different quality levels/SNR levels, etc.
- Image data integrity
- Transmission integrity/security
- Storage conditions.

Benefits of Compression

- It has the potential to save money by transferring less data across a switched telephone network, where the cost of a conversation is normally determined by its duration.
- It minimises not just storage requirements but also execution time.
- It also minimises the probability of transmission errors by transferring fewer bits.
- It also adds a layer of protection against unauthorised monitoring.

Main Challenges of Medical Image Compression as follows:

- Reducing noise from a medical image is primarily the first step; there's a chance that while removing noise, data might be deleted that would be essential to the patient's diagnosis. We cannot afford to lose data in the medical field, especially.
- Removing redundant or undesirable information from medical images is also a crucial task for compression; doctors know which parts of an image are critical, therefore there's a risk of losing important information from a medical image while compression.

Medical diagnostics such as teleradiology require enormous amounts of medical data to be stored and sent for storage. It is vital to use compression methods for effective storage and transmission. Basically, compression methods can be categorized into two types based on their lossy or lossless characteristics. Distortion levels determine whether a method falls into which category. Although lossy compressed images are visually acceptable, the details in a medical image are critical for accurate interpretation and diagnosis and hence lossless compression is preferred shows in fig.2. In addition, a 3D image is rendered for a particular body part that contains greater amounts of statistical redundancy. Therefore, the above-mentioned compression method is preferable. Images, especially medical images, are naturally composed of objects.

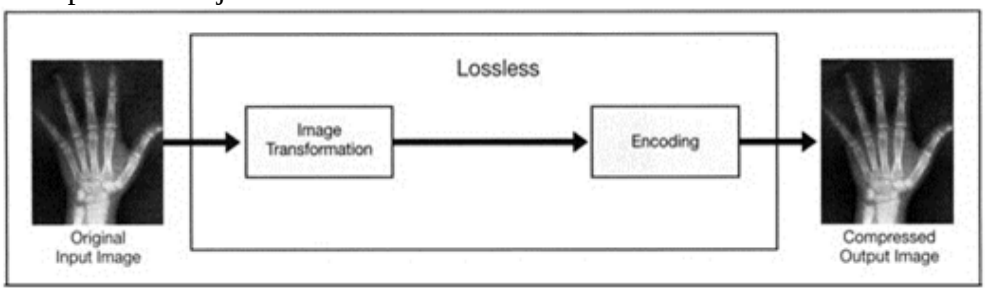


Fig.2 Lossless Medical Image Compression.

Lossless image compression technique is used in areas where data is critical, and loss of information is not acceptable. When the image is decoded, it completely matches with the original image without loss of data. As the name implies, lossless compression is reversible and does not result in information loss (i.e., null distortion level). Lossless compression methods are mainly divided into predictive-based methods and statistical methods such as Huffman Coding, Run-Length Coding, Arithmetic Coding, and Lempel-Ziv-Welch Coding (LZW), Embedded zero trees wavelet (EZW) etc.

When using any compression method, object-based coding is used as a means of increasing compression efficiency. The object refers to the area or part of an image that is important, such as the Region of Interest (ROI) in 2D images or the Volume of Interest (VOI) in 3D images. In terms of medical image compression, clinically important object is known as ROI

in the 2D images and in the case of 3D images it is known to be VOI fig.3. It may be tumor, brain active regions, and particular tissues or important portions [3].

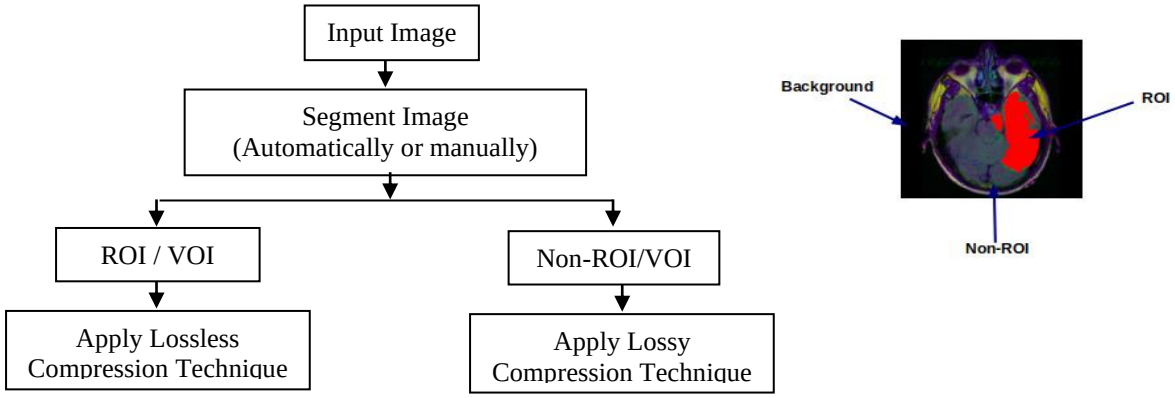


Fig.3 Image Segmentation based on ROI and Non-ROI

Most medical images are surrounded by no intensity background, so they are considered zero-intensity pixels. It was no more important during the diagnostics and analysis process. As a result of its limited pixel count, by separating the foreground (VOI) from the background, we are able to optimize compression performance. Additionally, those excluded backgrounds can be reconstructed during the decompression process to preserve the texture and appearance of the original image.

In the decompression procedure, the processed VOI is joined with the non-object region (background) with the help of non-object coordinate details intentionally included in the compressed file. By using object-based coding, certain compression algorithms can be enhanced, resulting in high fidelity on clinically relevant portions. It is true that object-based coding is the most efficient method for image compression, but the cost and complexity of these methods limit the compression's effectiveness.

Literature Survey

In 2017, Qingzhu Wang, et al presents the tensor compression detection function allows you to encode and compress a 3D sequence into a tensor instead of encoding and compressing multiple 2D images at the same time. The proposed method retains the internal structure of tensor-based 3D image sequences and provides a balanced compression rate, decryption accuracy and security. It is based on the extended TCS and Lorenz 3D components, and can use 3D images as tensors for encryption and decryption. The effectiveness of this method was tested on the lung images from Lung Imaging Database Association [4].

In 2018, M.A.P. Manimekalai, et al Use a hybrid image compression method based on LZW and CHE (histogram equalization after trimming). The proposed method uses a median filter for pre-processing. And used the deep jacquard interval convolution to divide the processed image into a Region of Interest (ROI) and a Region of no Interest (no ROI). Use Lempel-Ziv-Welch mixed signal and Cropped Histogram Equalization (CHE) to compress the ROI part. Non-ROI is compressed with Extended Zerotree Wavelet (EZW). Complete skull and MRI tumor images are used [5].

In 2019, Khalid M. Hosny, et al presents Legendre moments and differential evolution. The proposed method includes two steps: The first is to use Legendre moments to transform the image to generate Legendre coefficients and cost optimization function. The effectiveness of this method was tested in the axial view of the knee using MRI, abdominal CT and sagittal view of the knee. Generally, it provides a higher compression ratio [6].

In 2019, Shuai liu, et al presents a fast MRI image compression method based on fractal. In this method, the 3D MRI image is converted into a 2D image sequence, and then the regions and the region blocks are classified according to the inherent temporal and spatial similarity of the 3D objects. A residual compensation mechanism is introduced to achieve high MRI image compression. The encoding based on the quadratic integer quantization threshold is performed in an area with a more accurate threshold. In order to receive data, a stream with original data is transmitted [7].

In 2019, Boopathiraja Subramanian, et al presents a hybrid lossless compression technique with object-based features for 3D medical images. This study utilizes two phases; first, determining the VOI for a given image using Selective Bounding Volume (SVB) method, and second VOI is encoded using Lempel-Ziv-Welch Coding (LZW) followed by arithmetic coding (L to A). experimental results shows that the proposed method obtains superior result in comparable with other existing standards lossless encoding methods [3].

In 2020, Matina Ch. Zerva, et al presents the extension of the 3D wavelet difference reduction (3D-WDR) method that employs mean co-located pixel difference (MCPD) to estimate the optimal number of slices to be efficiently compressed in volumetric object. Used The Cancer Image Archive (TCIA) dataset. The proposed method achieved a high compression ratio with respect to improved PSNR (Peak Signal Noise Ratio) value [9].

In 2020, S. UmaMaheswari et al presents an adaptive image compression technique which has non-redundant tetromino basis functions and a fast filter bank technique. The proposed method is based on the hair wave transform, and performs the Chevrolet transform. The biggest advantage of waveform image compression is the ability to perform multi-scale analysis through the presence of the frequency spectrum. Wavelet is used to obtain the details of the image. Perform hair conversion on the input image. You will get new details. After selecting the appropriate tile. This method basically selects three images for testing, namely MRI, CT and normal images. the performance of this method is very high [10].

In 2020, Dr. K. Prabavathy, et al presents a hybrid method based on evaluation on SPIHT (Set Partitioning in hierarchical Trees) algorithm. The SPIHT is an image compression algorithm correlated with DWT and applies the principle of self-similarity across plane as it is been implemented by EZW. The proposed method was tested on scan images and x-ray images. The proposed method provides the better results [11].

In 2020, N.N. Kulkarni, et al presents ROI based Lossless compression using integer wavelet transform and Run-length coding. The proposed method is evaluated on MRI images. In this proposed method the pre-processing were done for filtering an image using various image processing tools. Then segmentation is done to obtain ROI and Non-ROI region. Once the ROI part is extracted then further compression process takes place. it concluded the better result in terms of Compression Ratio (CR), PSNR, and Mean Square Error (MSE). And it has less complexity and time for encoding and decoding process [12].

In 2019, James Townsend, et al presents fully convolutional VAE models trained on 32x32 ImageNet can generalize well, not just to 64x64 but also to far larger photographs, with no changes to the model. We use this property, applying fully convolutional models to lossless compression, demonstrating a method to scale the VAE-based 'Bits-Back with ANS' algorithm for lossless compression to large colour photographs, and achieving state of the art for compression of full-size ImageNet images. HiLLoC, an extension of BB-ANS to hierarchical latent variable models, and show that HiLLoC can perform well with large models. also explored generalization of large VAE models, and established that fully convolutional VAEs can generalize well to other datasets, including images of very different size to those they were trained on. We have described how to compress images of arbitrary size with HiLLoC, achieving a compression rate superior to the best available codecs on ImageNet images [13].

In 2018, Prof. Vijaya S M, et al presents Hybrid compression techniques are adopted to get efficient compression for medical images. This paper proposes an efficient method for the digital medical images in DICOM format. Medical images such as MRI images are broadly classified into Region of interest (ROI) and Non Region of interest (NON-ROI). The ROI consists of diagnostically important areas such as tumour region in MRI. The NON-ROI consists the remaining part of the medical image. The image is segmented using Fuzzy c-Means (FCM) algorithm and its accuracy is evaluated in terms of contrast, correlation, energy and homogeneity. For ROI lossless compression coding is applied so that the quality of the image is preserved and is encoded using Huffman coding, for NON-ROI lossy compression coding is applied using SPIHT compression algorithm. The hybrid method is evaluated in terms of Compression ratio (CR), Peak signal to Noise Ratio (PSNR), Structural Similarity Index (SSIM) and Mean Square Error (MSE) for various Brain MRI images [14].

In 2006, V.Sanchez, et al presents In this study, A lossless compression technique for 4D medical images which is based on the H.264/AVC video coding standard. Lossless compression technique efficiently exploits spatial and temporal redundancies between 2D image slices and 3D images in 4D medical images and eliminates any concerns regarding the effects of compression on image quality for diagnostic purposes. Performance evaluations have shown that H.264/AVC significantly outperforms 3D-JPEG2000, reaching an impressive 70% improvement [15].

In 2001, Salih Burak Gokturk, et al presents in this study, A hybrid scheme that is appropriate for efficient and accurate compression of 3D medical images. The model uses lossless compression in the region of interest, and very high-rate, lossy compression in the other regions. There are two main contributions of the paper: First, designed a compression scheme that automatically segments and utilizes ROI in order to get efficient and accurate results. Second, common compression schemes have been applied to CT abdomen images and the performances are compared. and have chosen motion-estimating coding as a prediction scheme for each medical abdomen slice. The difference between the ROI blocks and the prediction is coded separately with an entropy minimizing coder. Experiment is carried on CT abdomen images with the colon wall as ROI. The results show that a compression rate of 2.5% can be obtained by the proposed approach [16].

In 2020, O. H. Nagoor, et al proposed a novel lossless compression approach using Long Short-Term Memory (LSTM), it integrates a Recurrent Neural Network (RNN) as a 3D sequence prediction model. specially for compressing 3D medical images (16 bit-depths). The aim is to learn the long dependencies of the voxel's neighbourhood in 3D using Long

Short-Term Memory (LSTM) network then compress the residual error using arithmetic coding. Solved the lossless compression problem using LSTM-based sequence prediction model and 3D pyramid shaped sequences as models input. MedZip empirically demonstrates a significant reduction in the compressed size (BPP). Evaluation demonstrated on unseen modalities CT and MRI for the lossless compression scheme. Experiential results reveal that our method obtains a higher compression ratio achieving 15% saving compared to the state-of-the-art lossless compression standards, including JPEG-LS, JPEG2000, JP3D, HEVC, and PPMd. This is the first lossless compression method that uses LSTM neural network for 16-bit volumetric medical image compression [17].

Table1.1 Review Table

Ref	Compression Type	Method Used	Medical Modality	Merits
2	Hybrid	Median filter→ Pre-processing Jacquard Distance → segmentation Lempel-Ziv-Welch (LZW) and cropped histogram equalization (CHE)→ ROI. Extended Zerotree Wavelet (EZW)→Non-ROI	MRI	Good
3	Lossless	Legendre Moments Differential Evaluation → as optimization algorithm	MRI & CT	Heigh compression ratio with high quality outcome
4	Lossless	Huffman Coding	MRI	Compression speed improved
5	Hybrid	Selective Bounding Volume (SVB) LZW followed by athematic coding	MRI & CT	Superior outcome
7	Lossless	Tetrolet Transform	MRI & CT	High image quality with low noise
8	Lossless	Set Partitioning in hierarchical Trees (SPIHT) with Huffman coding & Bio-Orthogonal	MRI & CT	Good
9	Lossless	Integer Wavelet Transform Run Length coding (RLE)	MRI	Less complexity & less time for decoding
10	Lossless	VAE-based ‘Bit-Back with ANS	Large color image	Superior outcome for Different size images
11	Hybrid	Fuzzy C-means (FCM)→Segmentation Huffman Coding →ROI SPHIT → Non- ROI	MRI	Good and preserving the diagnostically important region
12	Lossless	Fidelity Range Extensions in H.264/AVC	MRI	Good improvement
13	Hybrid	Motion-estimating coding as prediction scheme	CT	Good
14	Lossless	RNN→ prediction model LSTM Neural network→ find long dependencies	NRI & CT	Good

Application

Telemedicine:

Telemedicine is the use of telecommunications and information technology to offer clinical health care to patients who are located far away. It is the use of electronic communications to transfer medical data from one location to another.

The two-way interactive television (IATV) is another popular device. When a 'face-to-face' consultation between the health professional and the patients is required, this is used. It frequently takes place between patients and their doctors in one location and a specialist in another.

There are numerous potential benefits of telemedicine, including:

- Improved access to information;
- Provision of previously unavailable care;
- Improved access to services and increased care delivery;
- Improved professional education; quality control of screening programs;
- Lower health-care costs.

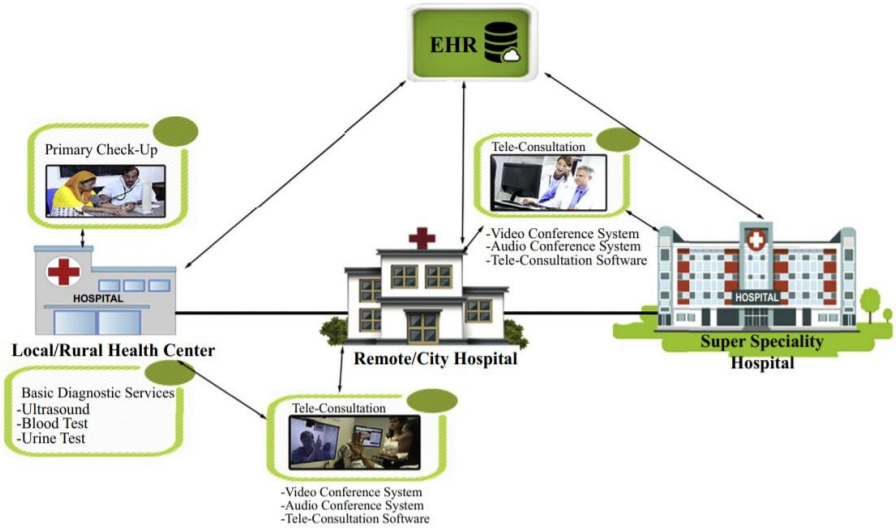


Fig.4 Remote health care System (Telemedicine)

- A patient in need of medical assistance goes to a nearby community health centre, where a local health professional (may not be a certified doctor) attends to the patient and does a basic health examination.
- This unit contains basic diagnostic equipment as well as teleconsultation devices that are connected to the city hospital via PC and the Internet. The primary responsibility of the local healthcare unit is to acquire all the vital statistics of the patient in terms of physiological data (e.g., blood, urine, etc.) and images (e.g., ultrasound) and transmits the data to the remote city hospital.
- After receiving the records, the remote medical professional examines them thoroughly before communicating in live interactions with patients. After thoroughly evaluating the basic vital signs, a meeting between the doctor and the patient at a remote healthcare unit is scheduled online.
- To have live interaction with the patient, the doctor uses an audio or video conference system as well as automatic video streams. These remote hospitals are linked to a centralized database that stores all of the patient's data, as well as other information and even the audio/video contact between the doctor and the patient.

- Mobile apps or a web-based interface can be used to access the stored information. In the case of emergency, the main hospitals are linked to specialist hospitals, which have the same teleconferencing units to support remote patients.

The growing need for storage space and bandwidth in the clinical setting has prompted the Picture Archiving and Communication Systems (PACS) community pushed for an all-digital radiological environment in hospitals, including capture, storage, communication, and display. Fast image recovery and transmission across the PACS network are made possible by image compression. PACS strives to provide a system integration solution that allows for a variety of activities other than computer aided diagnosis, such as teaching and examining patient data and mining clinical records. It's worth noting that the preservation of the original data is less essential in this scenario, and a loss due to compression might theoretically be allowed [1].

Compression techniques capable of providing quick access to a low-quality version of the images and/or a specific piece of them corresponding to the diagnostically relevant segment are required for fast inspection of enormous volumes of data. Advancement (or scalability) provides for incremental decoding of the bitstream to improve the quality of the recovered data. This allows medical personnel to begin diagnosing at a very early stage of transmission in teleradiology, and to eventually identify the region of interest to switch to a ROI-based mode.

There are two scalability options: quality and resolution. The image resolution does not vary during the decoding process in the scalability by quality mode. This means that when the decoding process begins, the image is recovered in full size but at a low quality, meaning that various forms of artefacts (depending on the coding technique) degrade the image's quality. The encoded information is organised in the scalability by resolution mode such that a reduced size version of the image is recovered at full quality right after decoding begins; the resolution (size) then increases with the amount of decoded information.

Problem Statement

The necessity to manage vast amounts of data on a regular basis raises the issue of compression in medical field. The goal is to reduce the amount of data that needs to be saved and/or delivered while retaining the diagnostic features. Because of the inconsistency of this problem when approached from a broad perspective, i.e., without referring to a specific imaging modality or disease, it was widely agreed that only compression techniques that allow the original data to be recovered without loss would be suitable. Another fundamental criterion is rate/distortion performance. In this case, lossless capabilities are a must, at least as far as diagnostics are concerned. In the medical imaging field, systems that provide lossless performance and quick access to the information of interest, as well as ROI-based capabilities and minimal processing complexity, are highly important.

Objectives:

To development of an efficient compression algorithm which provides progressive transmission across a network, with minimal transmission error.

- 2D/3D medical image from one of the medical modalities are taken as input by the algorithm.
- Performs nominal categorization of the ROI/VOI and Non-ROI/Non-VOI sections.
- Categorized image is decomposed using transformation methods.
- Carry lossless entropy coding algorithm on ROI/VOI region. And lossy entropy coding for the rest of the region.
- Analyze the performance of the developed algorithm with existing algorithms in terms of mean square error, Peak signal to noise ratio, compression ratio, etc.

Motivation

Open Issues/ Research Challenges: For medical image compression, a wide range of compression techniques is studied. Although these techniques are capable of producing considerable results, there are a number of unresolved challenges in the field of medical image processing, including:

- Some of the compression algorithms used in this study are capable of achieving higher compression ratio, but they are more advanced in nature and have efficiency and optimization difficulties.
- Some of the procedures are quite efficient and effective, but they take a long time to accomplish, which is a concern.
- Watermarking techniques in medical compression are capable of compressing images but not of preserving their quality.
- Most compression techniques employ MRI and CT as their modalities, but some of these techniques can only work on CT and MRI and not on other medical modalities, according to study.
- In ROI compression, the autoshaping is done manually by the physician i.e., chances of error should be there
- The optimal rate/distortion features, as well as ROI-based processing, were not enabled by the old JPEG standard, rendering it outdated. Other domain-specific constraints come into play when focused on medical imaging, in addition to these general needs.
- Visually lossless mode is a challenging condition to achieve. The goal is to create a system that allows for data compression while maintaining diagnostic accuracy. This specifically looks into problems that aren't covered by traditional signal processing,

Methodology

The purpose of the image compression algorithm is to reduce the amount of data required to represents the image with less degradation in the visual quality and without any information loss. Lossless image compression schemes exploit redundancies without incurring any loss of data. Lossless image compression is therefore exactly reversible. Lossless image compression techniques first convert the images into the image pixels. Then processing is done for each single pixel. Different Encoding Methods are, Huffman, Arithmetic.

In order to compress input images, consist the following phases; namely preprocessing, image transformation, Lossless entropy coding, and compressed image.

- Preprocessing phase takes images as input, so that the proposed approach resizes the image in accordance with the measured rate of different sizes to blocks and for improving the quality of medical images. It is used to suppress possible variations that arise during image acquisition or to remove noise or unwanted information from images without evading vital information. These variations hinder further image analysis steps.
- Image Segmentation of images plays a very significant role in the detection of significant regions that are used for the analysis of tissue types, pathological regions, and anatomical structures.
- Image transformation phase received the resizable grey scale images and produced transformed images using the different types of transform methods.
- Entropy encoding is a lossless data compression scheme that creates and assigns a unique prefix code to each unique symbol that occurs in the input. These entropy encoders then compress data by replacing each fixed-length input symbol by the corresponding variable-length prefix codeword. The length of each codeword is approximately proportional to the negative logarithm of the probability. Therefore, the most common symbols use the shortest codes.
- Analyze the performance of the developed algorithm with existing algorithms in terms of mean square error, Peak signal to noise ratio, compression ratio, etc.

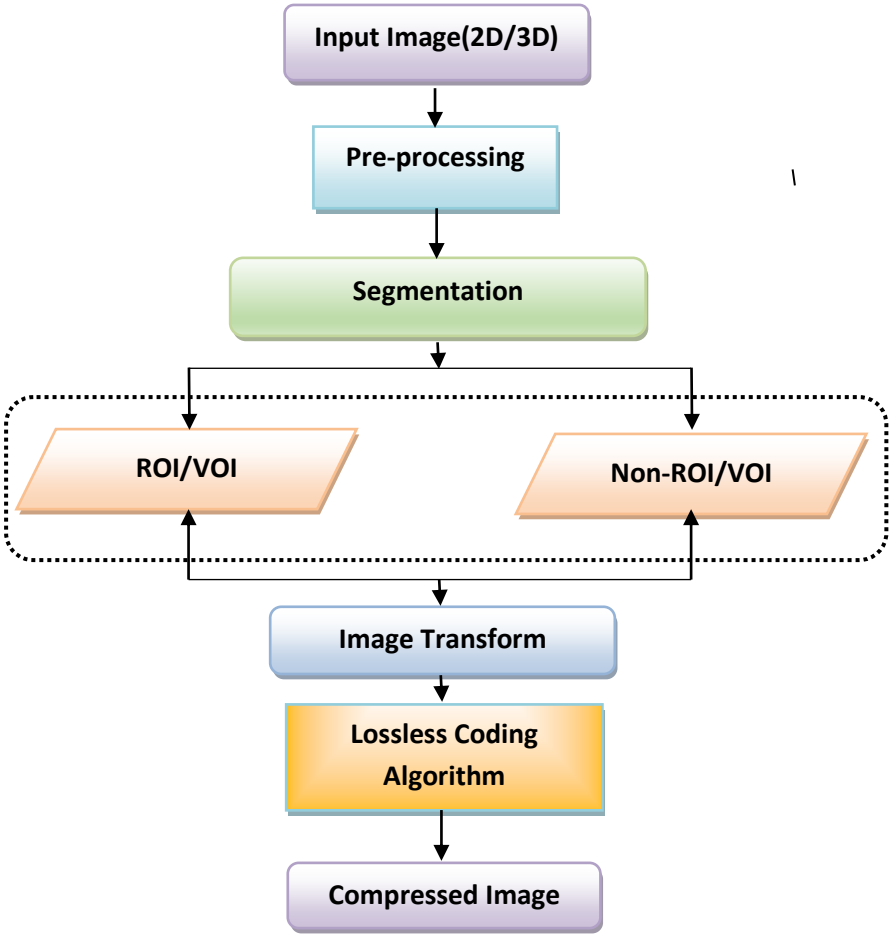


Fig.4. Flow diagram of proposed method

Outcome

The development and demand for multimedia products has accelerated, resulting in network bandwidth and memory device storage shortages. As a result, data compression theory is becoming increasingly important for minimising data redundancy and saving more hardware space and transmission bandwidth. Purpose of this study is to develop the image compression algorithm is to reduce the amount of data required to represents the image with less degradation in the visual quality and without any information loss.

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